TESTIMONY OF

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BEFORE THE
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Good afternoon, Chairman Boehlert, Ranking Member Hall and members of the Committee. I am James R. Mahoney, Assistant Secretary of Commerce and Deputy Administrator of the National Oceanic and Atmospheric Administration. I am appearing today in my capacity as Director of the Climate Change Science Program of the Interagency Working Group on Climate Change Science and Technology. The Climate Change Science Program integrates the federal research on global change and climate change, as sponsored by twelve federal agencies (NSF, DOC, DOE, EPA, NASA, DOS, DOI, USDA, HHS, DOT, DOD and the Smithsonian Institution) and overseen by the Office of Science and Technology Policy, the Council on Environmental Quality, the National Economic Council and the Office of Management and Budget.

I am very pleased to have this opportunity to present testimony on the Administration's scientific research program on global change and climate change. The status of the entire earth system, including the potential impacts of climate and ecosystem variability (regardless of its origin), is a capstone issue for our generation and will continue to be so for our children. The Administration fully embraces the need to provide the best possible scientific basis for understanding the complex interactions that determine the constantly changing nature of our earth's life systems. Moreover, the Administration is committed to making full use of our best scientific information to determine optimal investments and actions on the global, national and regional scales to mitigate adverse anthropogenic changes, and to adapt to unavoidable natural changes.

Comprehensive, objective, transparent and well-reviewed scientific inquiry must be the core methodology used to evaluate the complex relationships between natural and anthropogenic influences on earth systems, and to project the expected outcomes of the many different investment and action strategies that have been proposed to mitigate or adapt to potential changes in global conditions. If we fail to fully evaluate the scientific information bearing on global change, we would be subject to the justifiable criticism that our strategy to cope with potentially our largest-ever investment in environmental management would be seen as a "ready-fire-aim" approach.

During the past thirteen years the United States has made the world's largest scientific investment in the areas of climate change and global change research – a total investment of almost $20 billion. The U.S. Global Change Research Program (USGCRP), in collaboration with several other national and international science programs, has documented and characterized several important aspects of the sources, abundances and lifetimes of greenhouse gases; has mounted extensive space-based monitoring systems for global-wide monitoring of climate and ecosystem parameters; has begun to address the complex issues of various aerosol species that may significantly influence climate parameters; has advanced our understanding of the global water and carbon cycles (but with major remaining uncertainties); and has developed several approaches to computer modeling of the global climate.

Much scientific progress has been made since 1990, but substantial uncertainties remain to be addressed. For example, various global climate models project significantly different temperature profiles: from approximately 1 degree Celsius by the year 2100, to more than 4 degrees Celsius during the same period. Resolving this scientific uncertainty in global climate models will have a major impact on determining optimal types, amounts and schedules of greenhouse gas emission management; will help resolve key questions of the relative importance of the management of greenhouse gases, carbon-based aerosols and sulfate-based aerosols on long-term climate parameters; and will be essential to understanding the scope of any climate change impact on global ecosystems.

Scientific knowledge of the interactions between climate variability and global ecosystems has improved during recent years. However, understanding of specific cause-effect relationships, and prioritization of the most important relationships, is just beginning to emerge. Information about both "forcing" and "feedback" relationships in ocean-atmosphere-ecosystems interactions is urgently needed to understand the fundamental mechanisms, and to prioritize the important effects to be addressed. The climate-ecosystems questions require continued scientific inquiry on both global and regional scales.

Because of the scientific accomplishments achieved by USGCRP and other research programs during a productive *"period of discovery and characterization"* since 1990, we are now ready to move into a new *"period of differentiation and strategy investigation"*, which is the theme of the President's Climate Change Research Initiative (CCRI). In announcing the CCRI, the President directed us to reestablish priorities for climate change research, including a focus on identifying the scientific information that can be developed within 2 to 5 years to assist the nation's evaluation of optimal strategies to address global change risks. The President also called for improved coordination among federal agencies, to assure that research results are made available to all stakeholders, from national policy leaders to local resource managers.

We are energetically responding to the direction of the President, and the following comments summarize the actions taken by the Interagency Task Force to develop the most useful information to address climate and global change issues.

1. **Consolidating management of the USGCRP and CCRI activities**.

The President's direction for CCRI, focusing on the development of near-term decision support information, requires close integration with the many existing programs managed under the U.S. Global Change Research Program. This will ensure internal consistency of the CCRI research with the full body of global change information developed under the USGCRP.

To accomplish this integration of USGCRP and CCRI activities, the Interagency Climate Change Science Program has assumed oversight of both programs, with a single interagency committee responsible for the entire range of science projects sponsored by both programs. The Interagency Climate Change Science Program retains the responsibility for compliance with the requirements of the Global Change Research Act (GCRA) of 1990, including its provisions for annual reporting of findings and short-term plans, scientific reviews by the National Academy of Sciences/National Research Council, and periodic publication of a ten-year strategic plan for the program. Plans for these activities include:

- **Annual report**: *Our Changing Planet* for FY03 is currently undergoing agency review, and it will be published in September 2002. The *Our Changing Planet* series will be continued in future years, with increasing emphasis on detailed analyses of proposed mitigation strategies and other national "decision support tool" information.

- **Strategic Plan**: The 1990 GCRA stipulates that an updated ten-year "National Global Change Research Plan" be prepared for USGCRP every three years. In fact, no such ten-year plan responding to this requirement has been published since the original plan resulting from the 1990 Act was adopted. A fully updated strategic plan for the combined USGCRP and CCRI activities is currently being developed by the interagency group, based on the following information resources: the draft ten-year USGCRP strategic plan prepared prior to the President's CCRI initiative, the August 2001 CCRI summary of research options, the interagency review draft of *Our Changing Planet* for FY03, a comprehensive interagency inventory of climate and global change research programs completed during the past two months, and an updated statement of interagency research goals and priorities currently in final review. The updated draft plan will be posted on the USGCRP/CCRI web site by November 1, 2002, to be available for comprehensive review by the scientific community, interested stakeholders, the general public and interested international specialists at a public USGCRP/CCRI workshop planned for the Washington, DC area in early December 2002. (This workshop is further discussed below.) A final version of the plan, taking account of workshop and Academy review comments, will be published in March 2003.

- **Academy Review**: We will be requesting a full NAS/NRC review of the combined USGCRP/CCRI planning process and products. The National Academy will be asked to review the interagency draft plan available by November 1, 2002, the public review workshop process, and the post-workshop final strategic plan to be published in March 2003.

2. Implementing a new research strategy: a three-tier scope of inquiry.

Consistent with the move from the *"period of discovery and characterization*" to the "*period of differentiation and strategy evaluation*", future plans for the combined USGCRP/CCRI program are being focused on three broad tiers of activities: (1) *scientific inquiry*, which has been the core activity over the years, with several key issues continuing to await resolution, (2) *observations and monitoring systems*, which have always been part of the program, but which have not been sufficiently integrated or focused to support strategy analyses, and (3) development of *decision support tools*, including detailed analyses of projected environmental, economic and energy system outcomes of various proposed scenarios. The CCRI initiative will supplement the ongoing USGCRP work by providing targeted focus to elements of each of the three tiers, where significant 2 to 5 year improvements in decision-relevant information is possible.

The three tiers of inquiry are intended to focus the necessary resources on the key categories of information needed to underpin national decision-making on global change response strategy:

- **Continued science inquiry**: Much has been learned about greenhouse gas emissions, abundance in the atmosphere, radiative properties, reaction rates and removal rates; and global climate models have developed to the point of moderate utility as analysis tools for application on a global scale and over long time averaged conditions. However, significant uncertainties remain regarding several issues that are critically important for defining optimal strategies for the management of global change. Among several key uncertainties, the following are illustrative of the continuing need for improved scientific understanding:

    - The significant differences in long-term global average temperature changes projected by various well-recognized climate models.
    - The relative importance of (1) carbon-based (black carbon) aerosols, (2) sulfate-based aerosols and (3) CO_2 and other greenhouse gases in influencing climate change – each related to differing control strategies.
    - The uncertainties in understanding the dynamics of marine ecosystems in the carbon cycle. Typical ocean uptake of CO_2 by biological productivity is many times larger than total global fossil fuel CO_2 emissions. Enhancement of this biological productivity could affect future atmospheric CO_2 levels.
    - Major uncertainties in climate-ecosystems interactions, and land use/land cover influences on climate.
    - Uncertainties in understanding global water cycles, including the current inability of general circulation models to successfully represent water vapor transport in the equatorial regions.
    - The poor regional performance of current general circulation models, which severely restricts the examination of potential global change influences on key regional ecosystems such as bays, estuaries, and inland watersheds.

- **Increased emphasis on measurements and monitoring systems for climate and ecosystem information:** Observations and monitoring systems have been major elements of the USGCRP-sponsored scientific studies throughout the past thirteen years. Because additional space-based and *in situ* data are needed to improve our scientific analyses and computer models, and because stable, long-term measurement records are essential to interpret earth system variability and trend data, there is a critical need for a well-designed, comprehensive climate and ecosystem monitoring system. A comprehensive monitoring system will necessarily be global in scope, and the United States should continue to make leadership contributions to the global system design and implementation. The United States is already contributing to the development and operation of several global observing systems, including support for a wide array of NASA and NOAA satellites, the ARGO floats being deployed in the world's oceans, the Global Climate Observing System (GCOS) sponsored by the World Meteorological Organization, and the Global Ocean Observing System (GOOS) sponsored by the Intergovernmental Oceanographic Commission. Within the next few years data from these systems will provide substantially improved information for calibrating global atmospheric and oceanic circulation models and for understanding the mechanisms that contribute to climate and ecosystem variability.

  The combined USGCRP and CCRI program will place major emphasis on requirements-driven specification of comprehensive monitoring systems that incorporate the following attributes:

  - Development of "climate quality" data, with stable measurement methods, consistent exposures, good intercomparison between data sets, and back- and forward-standardization of long-term data records.
  - Provisions for high quality data assimilation methods, combined with efficient archiving and retrieval methods, to facilitate research, analysis and forecasting applications.
  - Creative capture of the relevant information from the myriad of special research projects conducted throughout the world during recent decades, to optimize the information available for scientific analysis and computer model evaluations of global change and climate change.
  - Special emphasis on the complex observations and monitoring systems needed to analyze terrestrial and aquatic ecosystem variability.

- **Substantially increased focus on the development of decision support tools**: The potential economic and energy security impacts of several commonly suggested global change and climate change mitigation strategies are very large – substantially larger than all other environmental controls imposed during the past 30 years for some suggested strategies. In view of the potentially high costs and energy security impacts, careful evaluation of the projected outcomes of a wide array of suggested mitigation strategies should be undertaken. Note that the scientific analysis should not be aimed at

recommending specific strategies. The scientific analysis should address *"if ..., then ..."* questions, and should focus on *comparisons* between suggested mitigation strategies.

The *highest and best use* of the scientific information developed in the combined USGCRP and CCRI programs should be the development of *comparative information* that will assist decision makers, stakeholders and the general public in debating and selecting optimal strategies for mitigating global change, while maintaining sound economic and energy security conditions in the United States and throughout the world. Significant progress in developing and applying science-based decision tools during the next 1 to 3 years is a key goal of the combined USGCRP and CCRI program. Examples of analyses expected to be completed during this time period include:

- Long-term global climate model projections (*e.g.,* up to the year 2100) for a wide selection of potential mitigation strategies, to evaluate the expected range of outcomes for the different strategies.
- Detailed analysis of variations from defined "base" strategies, to investigate the importance of specific factors, and to search for strategies with optimum effectiveness.
- Linked climate change and ecosystem change analyses for several suggested strategies, to search for optimum benefits.
- Detailed analyses of the outcomes that would be expected from application of the wide selection of energy conservation technologies, and carbon sequestration strategies, currently being investigated by the National Climate Change Technology Initiative.

3. **Maintaining a culture of open, transparent, well-reviewed scientific inquiry**.

The United States global change and climate change research programs must consistently meet the highest standards of credibility, transparency and responsiveness to the scientific community, all interested constituencies, and our international partners. To assure credibility, the scientific inquiries must be policy-neutral, and must focus on *"if ..., then ..."* questions. Appropriate products of the scientific inquiries include:

- The best scientific descriptions of current climate and ecosystems status, with particular emphasis on the factors that can impact (positively or negatively) the current conditions.
- Prioritization of the importance of the various factors that can change current climate and ecosystems conditions.
- Trend information (based on careful evaluation of measurement records, supplemented by reference to scientific and computer model analysis) that helps identify significant patterns of variability, and that suggests the high priority concerns regarding future changes in climate and ecosystems conditions.
- Descriptions of cause-effect relationships between key climate and ecosystem parameters. These descriptions should typically include both one-by-one cause-

effect descriptions relative to individual key factors, and multiple-relationship descriptions involving the combined influence of several key factors acting jointly.

- Global climate models, ocean circulation models and other integrated computer models that integrate our scientific information about climate change and ecosystem impacts, and that project future conditions expected to result from various strategies.
- Scientific evaluation of technology initiatives that translate the effects of proposed mitigation technologies into scientific parameters suitable for scenario analyses.
- Cost, economic and energy supply analyses related to various suggested scenarios that allow projections of the outcomes expected to result from the scenarios.
- Comparisons between a wide selection of suggested scenarios, that facilitate our search for the most effective and efficient approaches to mitigate the effects of both natural and anthropogenic caused climate change.
- Careful statements of the scientific uncertainties relative to each of the matters described above. Note that appropriate uncertainty statements should always be part of scientific descriptions.

To facilitate the development of scientific credibility in the conduct of the combined USGCRP and CCRI program, the following steps are being taken:

- All upcoming program plan and result information will be published for open review as soon as practical in each case.
- The planned December 2002 workshop will "jump start" a comprehensive review of the updated plans for the combined USGCRP and CCRI program.
- Ongoing reviews of the combined USGCRP/CCRI program will be sought from the National Academy of Sciences/National Research Council. Specifically, the Academy will be asked to review both the process and the substance of the updated program planning (including the public workshop) to be completed during upcoming months.
- The USGCRP/CCRI program management is regularly involved in ongoing discussions with a wide array of members of the national and international scientific community. The program encourages comments and critiques from all sources and welcomes in-person discussions, subject only to the practical limitations of staff time.
- The USGCRP/CCRI program management also welcomes communication and meetings (time permitting) with interested stakeholders and advocates for specific positions. The management has a clear guideline of strict neutrality in these communications, and a guideline of equal access for representatives of all positions.
- The program management will provide all plans and reports to interested members of Congress and their staff, as soon as such information is available.

Program representatives are available to meet with members and staff upon request.

4. Program status and plans

The following comments summarize elements of the current status and near-term action plans for the combined USGCRP/CCRI program, for the interest of the Committee.

- **Ongoing USGCRP project work:** Current USGCRP projects (*i.e.*, as funded in the FY02 budget) are underway according to the plans of the individual sponsoring agencies. The USGCRP coordinating office staff continues to collect interagency project information for integrated reporting. The USGCRP coordinating office staff will be augmented with additional specialists to address the focused questions raised by the President as part of the CCRI initiative. The combined USGCRP/CCRI coordinating office staff will move to 1717 Pennsylvania Avenue, NW in Washington as of October 1, 2002, when the lease on the current coordinating office space expires.

- **The August 2001 CCRI document:** A climate research planning group hosted by the Commerce Department prepared a working plan document (*i.e.,* not a final reviewed strategic plan) in August 2001, discussing options for additional, focused research aimed at improving short-term decision making related to climate change, as part of the Climate Change Research Initiative. This draft document was provided to the House Science Committee at their request, and is available to the public. This document is one of several resources being used to develop the new strategic plan for the combined USGCRP/CCRI program.

- **The ten-year National Global Change Research Plan for USGCRP:** A draft ten-year strategic plan was prepared in 2001, prior to the announcement of the President's Climate Change Research Initiative. The draft strategic plan is being updated to incorporate consideration of the CCRI activities. A revised draft strategic plan will be placed on the USGCRP/CCRI web site by November 1, 2002, in preparation for the December 2002 climate science planning workshop. The final version of the plan will be published in March 2003.

- **FY04 budget planning:** The interagency Climate Science Program working group is actively engaged in the development of FY04 agency budget requests that reflect the themes of the President's Climate Change Research Initiative: focused efforts to reduce scientific uncertainties on key issues; improved specification, development and operation of various climate and ecosystem monitoring systems; and increased emphasis on the development and testing of decision support tools to facilitate public debate on climate change issues.

- **December 2002 workshop on USGCRP/CCRI plans:** This workshop is being planned for the Washington, DC area, to provide a mechanism for broad scientific community and

stakeholder community comment on the program plans and the expected reporting schedule for the USGCRP/CCRI activities. The workshop will address:

- The focus on key unresolved scientific issues,
- The plans for a comprehensive approach to climate and ecosystem observations and monitoring systems,
- The plans to develop and demonstrate decision support tools to facilitate public and stakeholder debate about global change and climate change issues,
- The plans and schedules for future USGCRP/CCRI reports on specific findings, monitoring system designs and scenario analyses.

Thank you, Mr. Chairman and members of the committee. I look forward to the opportunity to respond to any questions you may have.

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Dr. Mahoney was born and raised in Syracuse, New York. He received a B.S. degree in Physics from LeMoyne College in his home town. His career since college has involved over 40 years of continuous focus on environmental management and the earth sciences, with an emphasis on the atmospheric, climate, hydrological and oceanographic areas. He has undertaken diverse responsibilities in academic, corporate, national government and international settings.

Dr. Mahoney received a Ph.D. degree in meteorology from MIT, and then joined the Faculty of Public Health at Harvard University, in its Department of Environmental Health Sciences. This early-career focus on public health and the environment has positively influenced all of his subsequent professional work.

Drawing upon his Harvard experience, Dr. Mahoney co-founded the environmental management company Environmental Research & Technology, Inc. (ERT) in 1968. ERT grew to become the nation's largest environmental firm by the end of the 1970's, operating throughout the United States and several other nations. In that period ERT became the largest employer of meteorologists and related technical specialists in the United States, except for the federal government itself. In 1984 Dr. Mahoney moved to the position of Director of the Environmental Industries Center at the Bechtel Group, Inc., in San Francisco. In this position he supervised Bechtel's domestic and international environmental programs.

Dr. Mahoney entered full-time public service in 1988 as Director of the National Acid Precipitation Assessment Program (NAPAP), working in the Executive Office of the President. NAPAP was a unique 10-year interagency program created by the Energy Security Act of 1979, and charged with recommending sound approaches to controlling acid rain effects, while providing for continued energy and economic security for the nation. His service as NAPAP Director included the completion of the 10-year program involving the work of more than 2,000 technical and economic specialists; the publication of a major, internationally reviewed acid rain science and technology compendium; and extensive issue analyses supporting the development of the Clean Air Act Amendments of 1990. Dr. Mahoney was awarded the Commerce Department Gold Medal in recognition of exceptional performance as Director of NAPAP.

Dr. Mahoney was Senior Vice President of the IT Group, Inc., an international environmental management firm, from 1991 to 1999. Among other responsibilities, he

served as President of IT's Consulting and Ventures Group, which conducted projects in nearly every state and at several international locations. During 2000 and 2001 Dr. Mahoney worked as an environmental advisor on several domestic and international matters.

Dr. Mahoney has worked in more than fifty other nations in several different roles: negotiating and overseeing international joint venture technical companies, representing the U.S. government in specialist exchanges, advising government agencies (particularly in developing nations) on sustainable industry, fishery and agricultural practices, and advising several United Nations and other international agencies.

Dr. Mahoney is a Fellow and former President of the 12,000-member American Meteorological Society, which serves the atmospheric, oceanographic and hydrological fields. As a result of a strategic review initiated during his term as President, AMS committed to a long-term program of support for science education at all levels, encouragement of technical careers for minority students, and the application of sound science to complex public issues including disaster preparedness, environmental protection and global climate change, among others.

Dr. Mahoney has served on several committees of the National Academy of Sciences dealing with weather and climate, environmental protection and science education. In 1999 he completed a term as Co-Chairman of the Academy's Board on Atmospheric Science and Climate.

On April 2, 2002, after confirmation by the United States Senate, Dr. Mahoney assumed the position of Assistant Secretary of Commerce for Oceans and Atmosphere/Deputy Administrator of the National Oceanic and Atmospheric Administration (NOAA). Referencing his new position at his swearing-in ceremony, Dr. Mahoney said, "NOAA has the benefit of a large number of highly skilled scientific, technical and administrative personnel, and I will do all I can to help enhance their careers and further improve NOAA's service to the nation and the world."

Dr. Mahoney has six adult children and eleven grandchildren. He and his wife Taya also have five-year-old twin daughters.